TECHNICAL MEMORANDUM

ATMOSPHERIC LABORATORY FOR APPLICATIONS AND SCIENCE (ATLAS), MISSION 1

INTRODUCTION

The first Atmospheric Laboratory for Applications and Science (ATLAS 1) is a NASA mission with an international payload, with the European Space Agency providing operational support for the European investigations. The ATLAS 1 represents the first of a series of shuttle-borne payloads which are intended to study the composition of the middle atmosphere and its possible variations due to solar changes over the course of an 11-year solar cycle. One of the ATLAS missions will coincide with NASA's Upper Atmospheric Research Satellite (UARS) mission and will provide crucial parameters not measured by the instrument complement on the satellite. A first in this evolutionary program, the ATLAS 1 will carry a payload of instruments originally flown on the Spacelab 1 and Spacelab 3 missions. The Atmospheric Laboratory for Applications and Science Mission therefore exploits the shuttle capability to return sophisticated instruments to the ground for refurbishment and updating, and the multi-mission reflight of the instruments at intervals required by the scientific goals. In addition to the investigations specific to the ATLAS objectives, the first mission payload includes others that are intended to study or use the near Earth environment.

The primary components of the equipment for Earth investigation are mounted on two pallets as shown in Figure 1.

Overall management of the ATLAS 1 is assigned to the Office of Space Science and Applications at NASA Headquarters. The Marshall Space Flight Center (MSFC) in Huntsville, Alabama, is the project management center for the mission. Dr. D. Butler of NASA Headquarters has been designated the Program Scientist for ATLAS 1 and Dr. M. R. Torr of MSFC is the ATLAS 1 Mission Scientist. ATLAS 1 investigations originate from the United States, Japan, Belgium, France, and Germany. Figure 2 shows the geographic distribution of the Principal Investigators for ATLAS 1.

The first ATLAS will be launched from the Kennedy Space Center (KSC). The mission duration is planned for 9 days at an orbital altitude of 250 km and an inclination of 57 degrees. Launch is presently planned for late 1990.

A total of seven crew members will operate the science instruments, the Spacelab systems, and the Orbiter. The Orbiter will be operated by the Commander and Pilot. Mission Specialists will be primarily responsible for the operation of the Spacelab systems, but will also be involved in the conduct of scientific investigations. The Payload Specialists, Drs. B. Lichtenberg and M. Lampton, are scientist crew members selected by the scientists who have developed the investigations for the mission.

Science operations will be conducted continuously during the mission, requiring alternate 12-hour shifts by the onboard crew and around the clock support by the mission planners, controllers, and science teams. A cadre of support personnel will direct and assist the onboard crew in performing the investigations according to a preplanned timeline, which can be revised throughout the mission if circumstances

require it. Science operations will be directed, with guidance from the investigators, by the Mission Scientist.

At present, the mission science payload comprises 11 investigations. These are located on the pallets. Several of the instruments have dedicated experiment controllers located in the aft flight deck (AFD) for access by the flight crew. The physical location of each instrument is shown in Figures 3 and 4.

The first ATLAS is a multi-discipline mission, comprising four broad areas of science: Atmospheric Science, Solar Physics, Space Plasma Physics, and Astronomy. Table 1 lists the investigations by number, discipline, title, principal investigator, and the sponsoring country or organization.

The atmospheric science investigations will study the composition of the atmosphere in the stratosphere, mesosphere, and thermosphere (15 km to >250 km). These observations will employ a variety of spectrometric techniques extending from the extreme ultraviolet to the millimeter wavelengths, using both the emission and absorption of light by the atmosphere.

The solar physics investigations will measure the total energy output of the Sun using three different methods. The goal of these investigations is to determine quantitatively and with precision any variations in the solar energy output. Such information is important not only for its effect on the composition of the Earth's atmosphere and ionosphere, but also to studies of physical processes on the Sun and for studies of the Earth's climate.

Space plasma physics investigations will study the charged particle and plasma environment of the Earth. Both active and passive probing techniques will be used to investigate key cause-and-effect relationships that couple the Earth's magnetosphere, ionosphere, and atmosphere. Electron and plasma beams will be injected into the ambient plasma in order to study phenomena such as aurora and spacecraft charging.

The astronomy investigation will study astronomical sources of radiation in the ultraviolet wavelengths that are inaccessible to observers on Earth.

The investigations that comprise the ATLAS 1 mission will acquire fundamentally important knowledge of the physical processes which control man's environment.

The experiment descriptions in this report have been grouped into four sections, each corresponding to one of the discipline groups.

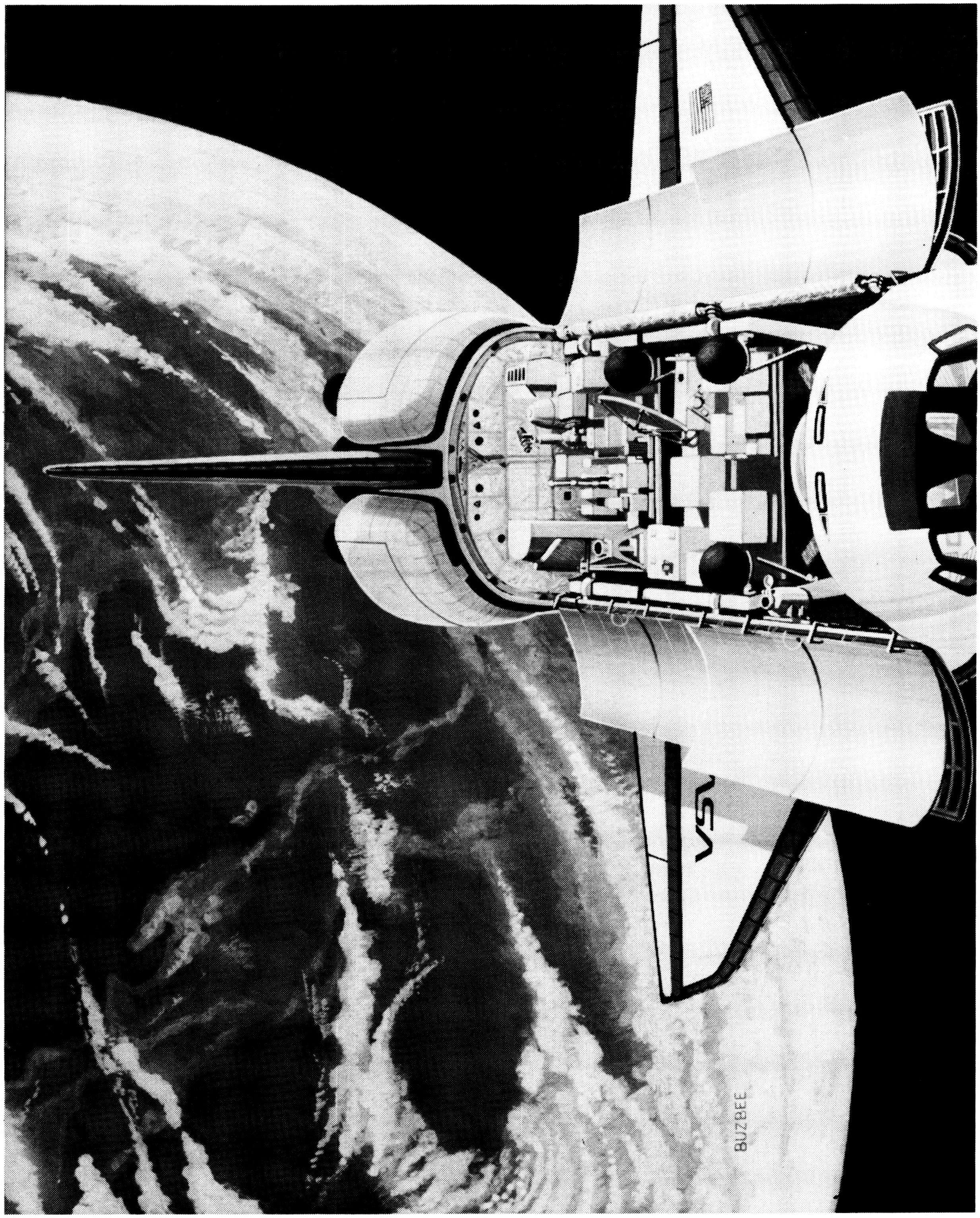

Figure 1. ATLAS 1 mission configuration.

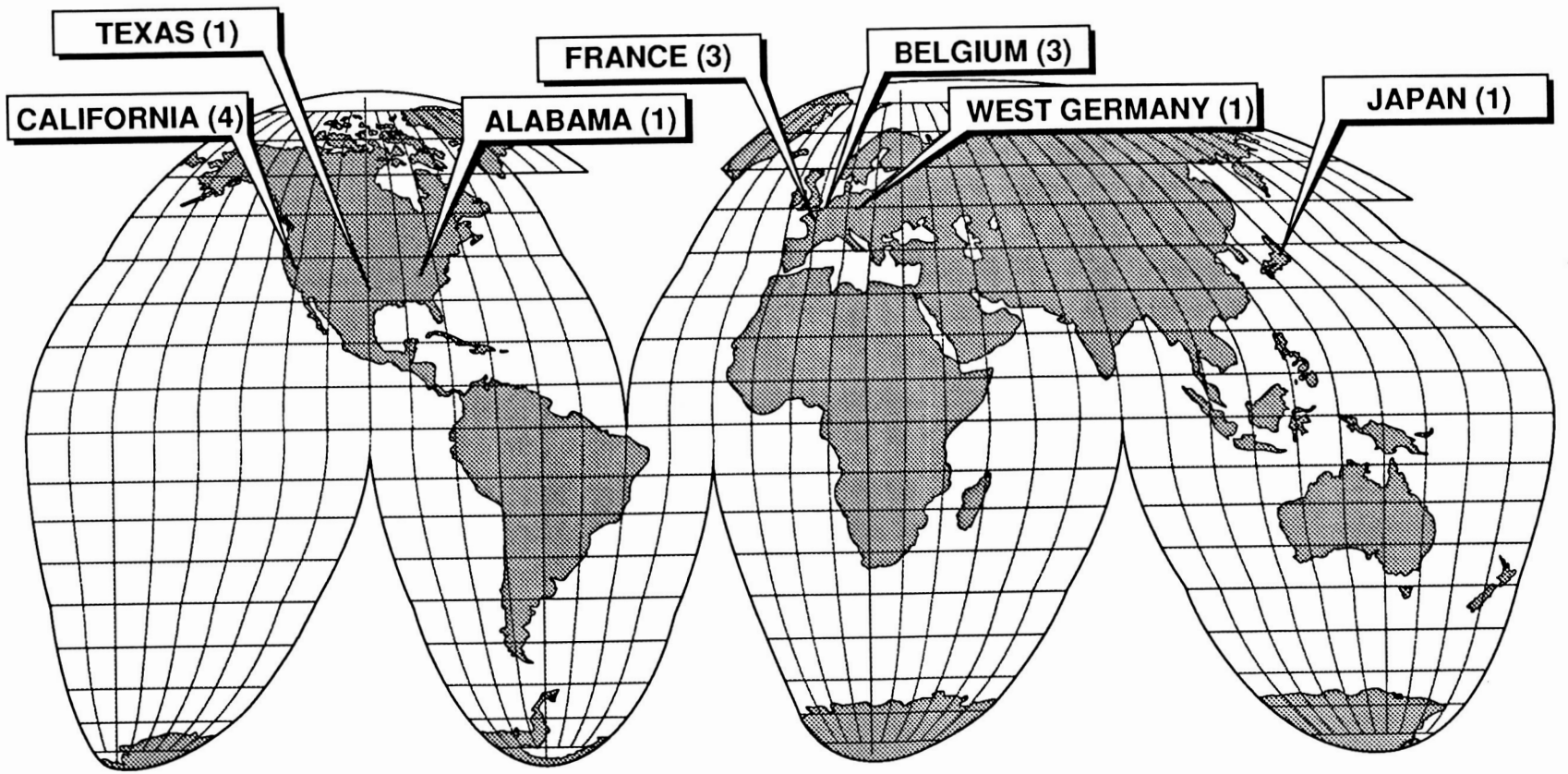

Figure 2. Geographic distribution of the investigators for ATLAS 1.

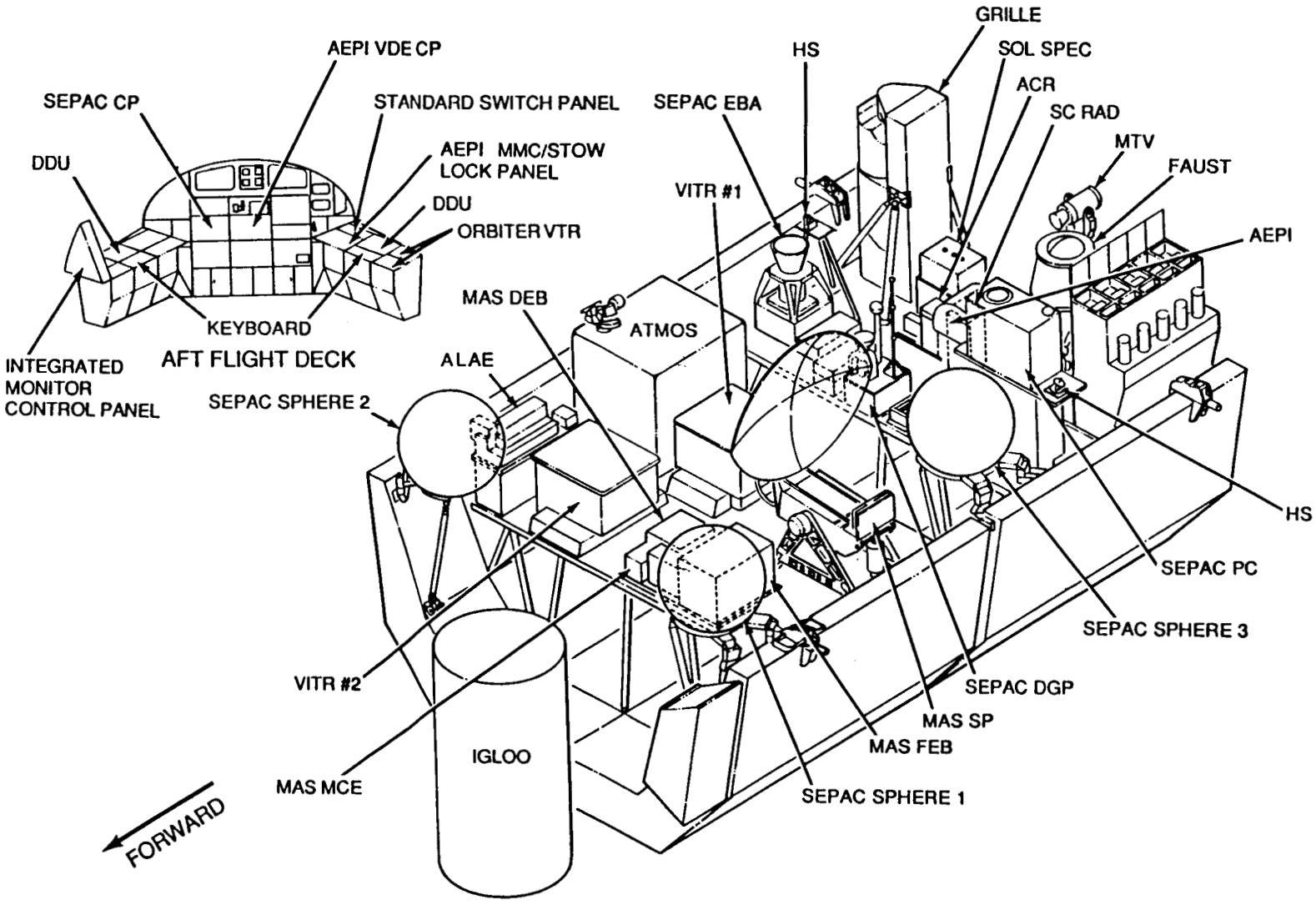

Figure 3. ATLAS 1 pallet plan view.
(NOTE: The position of the instruments in the final flight configuration may differ slightly from that shown here.)

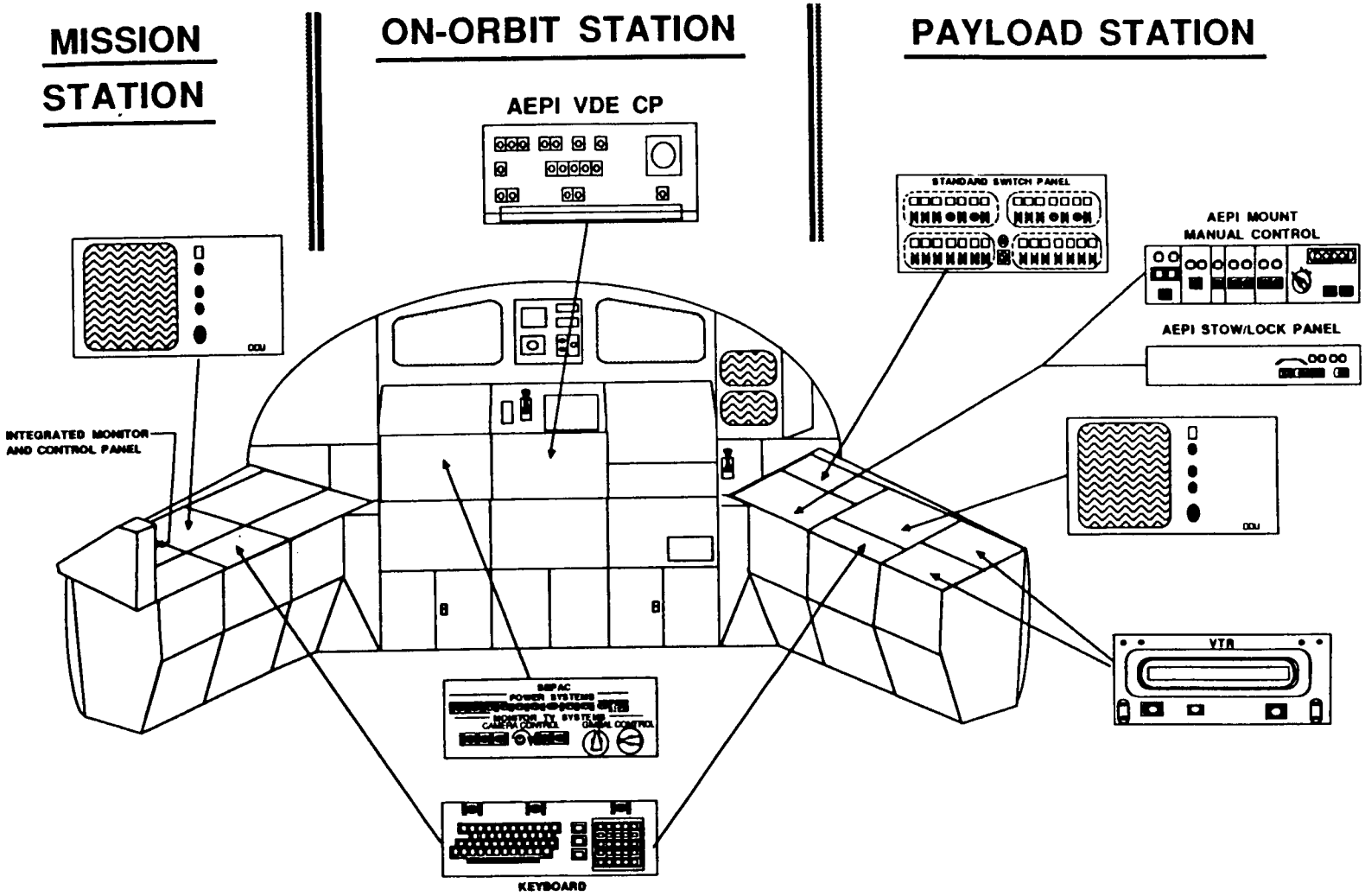

Figure 4. Layout of aft flight deck on ATLAS 1.

TABLE 1. INVESTIGATION TITLES AND PRINCIPAL INVESTIGATORS

Discipline	Experiment Number	Title	Principal Investigator/ Sponsor
Atmospheric Science	E017	Atmospheric Lyman-Alpha (ALAE)	J. L. Bertaux/France
	N009	Atmospheric Trace Molecule Observed by Spectroscopy (ATMOS)	C. B. Farmer/NASA
	E013	Grille Spectrometer (Grille)	M. Ackerman/Belgium J. Besson/France
	N001	Imaging Spectrometric Observatory (ISO)	M. R. Torr/NASA
		Energetic Neutral Atom Precipitation (ENAP)	B. A. Tinsley/NASA
	E034	Millimeter-Wave Atmospheric Sounder (MAS)	G. K. Hartmann/ W. Germany
Solar Physics	N008	Active Cavity Radiometer (ACR)	R. C. Willson/NASA
	E021	Solar Constant (SOLCON)	D. Crommelynck/ Belgium
	E016	Solar Spectrum (SOLSPEC)	G. Thuillier/France P. Simon/Belgium
Space Plasma Physics	N003	Atmospheric Emissions Photometric Imaging (AEPI) Experiment	S. Mende/NASA
	N002	Space Experiments with Particle Accelerators (SEPAC)	T. Obayashi/Japan
Astronomy	N005	Far Ultraviolet Astronomy Space Telescope (FAUST)	C. S. Bowyer/NASA